

RANCH DAY

OCTOBER 8, 1951

New Mexico Experiment Station, New Mexico Extension Service
Southwestern Forest and Range Experiment Station



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Livestock Improvement Is Part Of Good Ranch Management

Experimental Ranch

New Mexico College of A. and M. A.

Jornada Experimental Range

Southwestern Forest and Range Experimental Station

ELEVENTH ANNUAL RANCH DAY
New Mexico College Ranch and Jornada Experimental Range
October 8, 1951
Las Cruces, New Mexico
Ivan Watson, New Mexico Extension Service, Presiding

- 7:30 a.m. Leave Courthouse, Las Cruces. 8:00 Leave Radium Springs
- 8:20 Seldon Well. Feed consumption by two types of cattle --
J. H. Knox.
- 9:15 Pasture 3. Early signs of downward trend in range
condition -- K. A. Valentine.

Digestibility and nutritive value of important range
forage plants -- W. E. Watkins.
- 10:15 Pasture 2. A summary of mesquite control trials on
the College Ranch -- J. J. Norris.
- 11:10 Headquarters. Poison plant exhibit -- J. J. Norris,
in Charge.
- Lunch
- Welcome -- John W. Branson, President, New Mexico College
of Agriculture and Mechanic Arts.
-- Raymond Price, Director, Southwestern Forest
and Range Experiment Station.
- Remarks -- Roy Forehand, President, New Mexico Cattle
Growers' Association.
- The dwarf problem in beef production -- Dr. P. W. Gregory,
University of California.
- Breeding productive cattle -- George Ellis, Bell Ranch,
New Mexico.
- 1:45 p.m. Enter Jornada Experimental Range. Current conditions
and drought management on the Jornada -- F. N. Ares.
Measuring range condition and trend -- C. Kenneth Pearse.
- 2:45 Pasture 9. Present outlook for practical mesquite
control -- G. E. Glendenning.
Recent accomplishments in range reseeding -- H. W.
Springfield.
- 3:55 Camp Well. Type and size studies in beef cattle --
Ralph M. Durham.

THE TEXAS DEPARTMENT OF AGRICULTURE
AND MECHANICAL INDUSTRIES
REPORT
ON THE
ANNUAL REPORT OF THE
TEXAS DEPARTMENT OF AGRICULTURE
AND MECHANICAL INDUSTRIES
FOR THE YEAR 1900

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JORNADA EXPERIMENTAL RANGE

Jornada H.Q.

Rincon

2

16
Mayfield
Well

9
Stop 6

5
Camp Well

Co-op
Well

Stop 5

Stop 7

14
Seldon
Well

Stop 1

College H.Q.

Lunch 3

South
Well

COLLEGE
RANCH

Sumnerford Mts.

Las Cruces

SECTION OF COLLEGE RANCH AND JORNADA EXPERIMENTAL RANGE

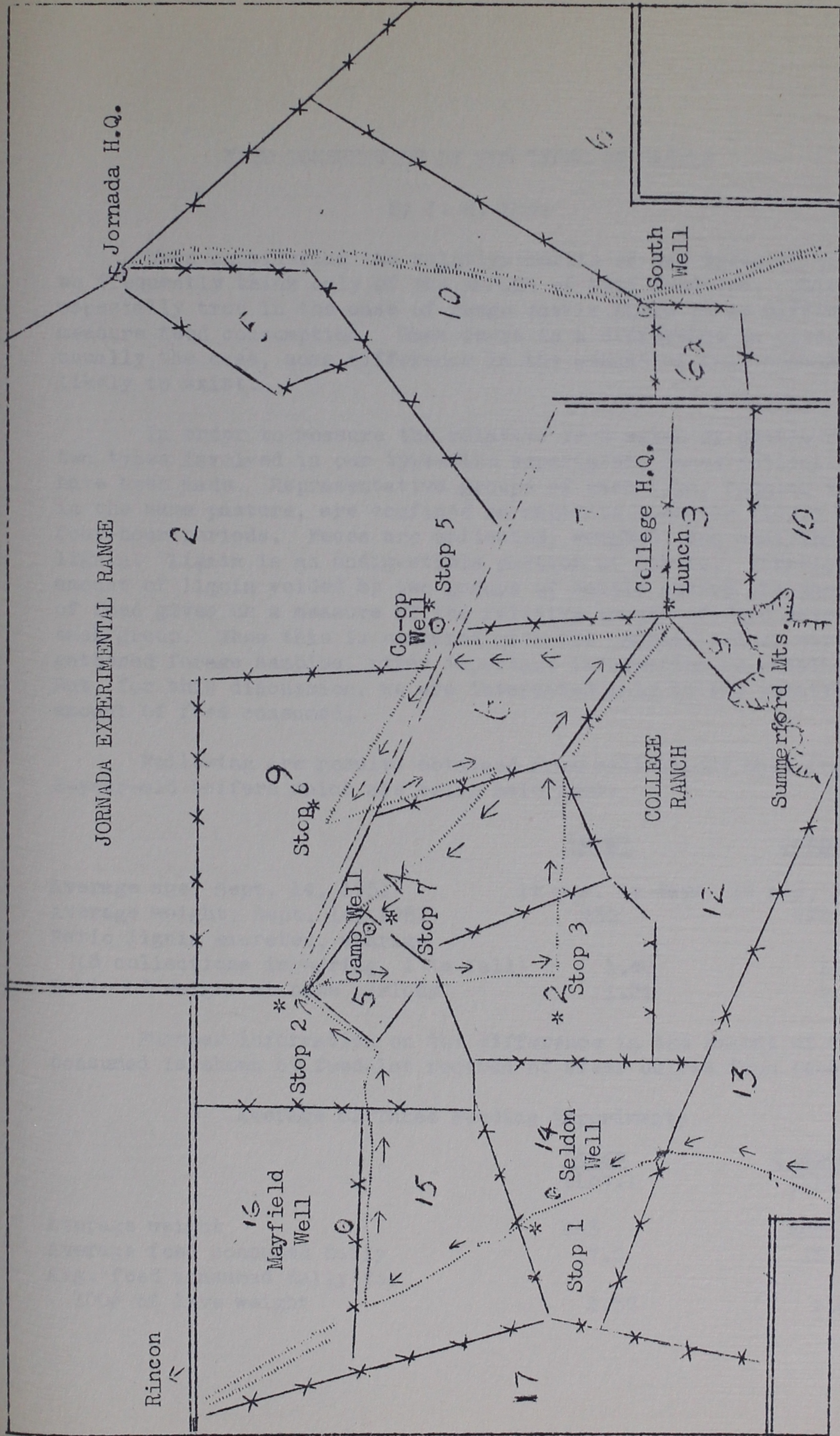
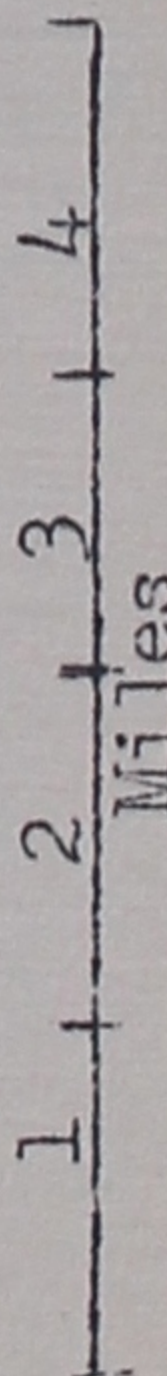
SHOWING RANCH DAY ROUTE, 1951

Legend

- Well
- Pasture No.
- Stop

- Division Fence
- Route
- Boundary Fence

↙ Radium
Springs



FEED CONSUMPTION BY TWO TYPES OF CATTLE

By J. H. Knox

When considering the relative merits of two types of cattle we frequently think only of the amount of beef produced. This is especially true in the case of range cattle where it is difficult to measure feed consumption. When there is a difference in size, as is usually the case, some difference in the amount of feed consumed is likely to exist.

In order to measure the relative feed eaten by cattle of the two types involved in our type-size experiment, feces collections have been made. Representative groups of each type, running together in the same pasture, are confined on separate concrete floors for four-hour periods. Feces are collected, weighed, and analysed for lignin. Lignin is an undigestible portion of plants. Therefore the amount of lignin voided by two groups of cattle eating the same kind of feed gives us a measure of the relative amount of feed eaten by each group. When this is compared with the composition of carefully gathered forage samples, other important information is obtained. But, for this discussion, we are interested only in the relative amount of feed consumed.

Following are results obtained from collections made from the 2-year-old heifers which are being held here:

	<u>Large</u>	<u>Compact</u>
Average age, Sept. 14, 1951	17 mos. 11 days	16 mos. 21 days
Average weight, Sept. 14, 1951	930	772
Ratio lignin excreted, average (3 collections in spring, 1 in fall)	1.40	1.00
Ratio of weight at same periods	1.31	1.00

Further information on the difference in the amount of feed consumed is shown by feed-lot records of steer calves from these groups.

Average of Three Feeding Experiments

	<u>Large</u> (Lbs.)	<u>Compact</u> (Lbs.)
Average weight	663	605
Average feed consumed daily	17.0	15.7
Avg. feed consumed daily for 100# of live weight	2.57	2.60

If these preliminary results are borne out by later work here and at other stations, it appears that we will have to look for other things to show differences in profit from these two types; for if feed consumption is in proportion to size, it will also be in proportion to rate of gain since size is the result of rate of gain. There may be differences in reproduction. Advantages may be found for big cattle in that some expenses, such as taxes and vaccines to mention but a few, are no greater for big than for small cows. On the other hand, sometimes the smaller, more compact cattle have sold for a higher price per pound. In any case we should not overlook the fact that there are great differences between cattle of all types giving much chance for selection in whatever kind we are producing.

EARLY SIGNS OF DOWNWARD TREND IN RANGE CONDITION

By K. A. Valentine

The reason for including this title on our tour this year lies in the fact that extensive areas of rangeland in the state, especially in the western part, have been damaged in varying degrees by drought and the almost inevitable concomitant of drought - damaging use of the deficient forage growth by livestock. We, of course, recognize that the drought is entirely beyond the control of the range manager and some heavy use accompanying drought is difficult if not practically impossible to avoid. We must also recognize, however, that damage has been done and that this can only be repaired through planned careful management of the range following the drought. In a sense our title may not be fitting, for much of the rangeland has indeed gone beyond initial stages of "downward trend." Still what is said of the early signs continues to apply in greater degree to the more advanced stages of downward trend. It is of great importance, however, to recognize the signs of downward trend in early stages and apply early remedial management. This is particularly true on sandy semidesert ranges. Here, droughty climate, unstable soil, and slow reproduction and spread of the better range grasses operate to accelerate downward trend and retard the restorative process. While we are basing our discussion on what we can see on this particular area, the main points are applicable to all rangelands. The differences on different types of rangeland will only involve the details of species of plants, kind of soil, topography, degree of use, agent or factor actively causing erosion, etc.

We have on the area where we are now stopped, several of the signs on which we want to base our discussion. This area has been subjected to destructive use for the past few years in connection with a winter supplemental feeding experiment with which some of you may be acquainted. We fully recognize the grazing to be damaging but to the present, irreparable harm has not been done and we expect to be able to avoid prolonging the damaging use to the point where critical harm will be done. It is important that we recognize this area as exhibiting definite early signs of downward trend even though the stand and composition does not show advanced damage.

Before we proceed, we need to define the term "range condition." As we are using the term here, we mean the actual average productivity of the vegetation and stability of the soil in comparison with the best that the site is capable of producing and being. Some have defined range condition as the state of health of the range and here again the basis of comparison is the most productive and soil protective cover that the site is capable of supporting. We need here to distinguish between range condition as we have defined it and the meaning "current forage production compared to average forage production on the area", commonly attached to the term.

Now let us pass on to the signs of trend which we are to consider. The very first sign we will observe is continued close use of the better range plants - use beyond their capacity to withstand. Here we have a single species, black grama, which first receives destructive use such as you see here. We have observed repeatedly in our pastures that when use such as this is continued a few years, a downward trend in condition sets in. We do not want to convey the impression that any and all grazing use is indicative of a coming decline in range condition. This is not true. A range under proper use may remain in just as good condition as one lightly used or unused. In fact there is good reason to believe that under proper use the condition of the range may be better than a range under no use. Nor should we consider that a single year, or possibly even two or three years of heavy use, are positive indicators of a coming decline in productivity of the range. It is undisputably true, however, that if use such as this is prolonged for several years a decline is inevitable. The decline will, in fact, be under way.

We will, of course, recognize that the same degree of use we see here may not be destructive for some other desirable species and be more destructive for still others. For example, it seems possible to graze blue grama to this same stubble height for a number of years and still have it hold its own and form a protective soil cover. On the other hand, some of the taller bunchgrasses, such as the beardgrasses, probably would fail as quickly, or more quickly, than the black grama. Black grama is, however, regarded as being comparatively sensitive to close grazing.

It is of paramount importance to realize that the proper use of a palatable range grass like black grama is appreciably less than the degree to which a grazing animal can graze it. There is still some appreciable stubble left when the proper degree of use is reached.

The next sign of downward trend which becomes evident on the range is low vigor in the more desirable plants. Vigor may be regarded as the state of health of the individual plants. It has also been defined as the capacity of the plant to grow thriftily when external conditions are favorable. The exact evaluation of vigor is somewhat troublesome. Technical range workers make use of recorded observations of number and size of stems, leaves, and flowering structures as indices of vigor but the practical man need not resort to such detail. He may judge vigor in a plant in a similar way with which he does an animal. In the animal he may judge vigor by observing size, condition, action, etc. In the plant he can effectively judge vigor by over-all size, color, presence and size of reproduction structures, such as stalks, runners, etc. but without going to the trouble of making measurements and counts.

It is important in this connection, however, that one have a good mental picture of a plant in average vigor, one in poor vigor, and one in good vigor as a basis for judging. We have mounted several black grama plants here to illustrate these three degrees of vigor in

this species. Other species will, of course, exhibit different sizes than black grama but they will also exhibit enough range in size to indicate to the careful observer a distinct difference in vigor. Such information for the few most important or key species on any range land is not hard to learn and carry in mind.

Signs of low vigor are not confined to the tops of plants on the range. The roots of plants in low vigor show evidence of this condition although it must be admitted that their position in the ground makes them difficult to observe. Roots of grasses in poor vigor are commonly shorter and less numerous than roots of vigorous plants. We can see from the mounted specimens that the small size of tops in the low vigor plants is matched by small size of the root system. As we have indicated, observation of root systems is not easy and for this reason they are not commonly used as signs of poor vigor. It is well to be mindful, however, that poor roots invariably accompany poor tops even though we do not see them. As a matter of fact, numerous experiments have shown that root systems commonly suffer a greater degree of reduction in size by comparison with normal plants than do the tops. It will be readily appreciated that root systems in low vigor can not absorb water from the soil as readily as more vigorous root systems. This has the effect of penalizing the affected plants in their competition for the generally limited moisture of the range and favoring other less desirable plants which are not in poor vigor.

Following decreased vigor and competitive capacity of the better plants, and because of it, we commonly see another sign of downward trend in an increase of undesirable or less desirable plants. On this type of range, several annual weeds and grasses, fluff grass and snake-weed are perhaps the most common examples of the more undesirable types of plants whose immediate increase indicates a decline. Some of the plants that exhibit an increase are not without value themselves but they do not equal the better grass or grasses that they replace. Certain dropseed and threeawn grasses are examples of such plants for this range. These grasses do have their value which in some respects is superior to black grama, i.e. they commonly furnish a small amount of green forage early in the year when black grama is completely dormant. For this reason they are desirable in restricted amounts; however, they are by no means a fair exchange for the black grama when they replace it to a great extent. They do not yield an equal amount of forage acre for acre, year in and year out, nor do they afford the density and stability of cover needed for adequate soil protection.

We are at a disadvantage here this year in being unable to see these plants developing in a normal way. Drought this year and last has so restricted growth as to obscure this process. The annuals and snakeweed especially are noticeably lacking. They will almost certainly increase, however, with the return of favorable growing conditions, before a return of vigor in the more desirable grasses can prevent it.

It will be remembered that we included soil as an element in defining range condition and for this reason we correctly look for some sign of soil deterioration to indicate a decline in range condition. Almost any observable erosion or deposition of soil by either wind or water is to be regarded as indicating downward trend. This is frequently difficult to detect in early stages and commonly our difficulty is due to the fact that we have few areas showing only natural erosion on which to base our judgment. We do have signs of early movement, however. Careful observation reveals that here soil is blowing out from between the plants. This is evidenced by slight pedestalling and increase of coarse soil particles and fine gravel and stones in the small "blow-outs." The degree of disturbance is not thought to be at all critical but it can not be allowed to progress much more without definitely harmful results.

This matter of soil stability is of primary importance. Not only must we not lose soil from an area but it must not drift and blow about on the area. We commonly regard the more important grasses on this type of range as being adapted to and in fact favored by sandy soils. This is true but those soils must be stable. The better range plants are just as greatly damaged by being partially excavated or partially buried as by close grazing use.

We have taken up the matter of soil instability last but it is not our intent to imply that it always follows after the shift in species composition of the range cover mentioned before. In fact, there is some reason to believe that under conditions of drought such as have prevailed here soil instability may accompany or even precede the shift to less desirable species since the drought has to some degree prevented the increase of these plants.

We have now covered the several chief indicators of incipient range decline but certainly we must all agree that if we carry our action only to the point of recognizing these things in the field without inaugurating a restorative program we are falling short of doing a good job of range management. It is perhaps of value now to consider very briefly the restorative process and how it proceeds. It might seem logical to assume that this process would be the exact reverse sequence of the steps we have outlined. This is not true. We can not move from unstable soil to stable soil, then from excessive proportions of undesirable plants to maximum or optimum proportions of the better plants, then from low vigor to high vigor, all of which would mean the restoration of good condition. The reason for this is simple. Basically soil instability is the effect of inadequate protective cover; the inadequate cover is an effect of poor vigor and competitive strength of the more productive and protective plants and of excessive grazing use; and poor vigor and competitive ability are effects of drought and destructive use. The restoration process will proceed only when the correct step is applied at the cause end of the chain of causes and effects. Conservative use in combination with favorable growing conditions are the basic requirements for initiating the restoration to good condition. It is certainly to be hoped that the climatic conditions necessary to support the process will not be long delayed.

In concluding this presentation we would like to call attention to the necessity for making careful and detailed observations. It is not necessary for the practical man to measure and count and record his observations as does the technical range man but this does not mean that he need not notice the details of size, number, etc. There is nothing that happens to the range that doesn't happen to the individual plants and small soil surfaces that make it up. If the several thousand desirable plants that comprise the range vegetation on an acre are overused and giving way because of low vigor and low competitive strength, then the acre of range is exhibiting a decline; if the several thousand plants are gaining in vigor, reproducing and out competing the less desirable ones, the acre is on the mend. It is similar with the separate several thousand square feet of soil surface comprising the acre. It can't be otherwise. This necessitates attention to the details of use, vigor, reproduction, difference between species of plants, erosion, etc. of representative individual plants and small soil surfaces on the part of the practical man no less than the technical man.

In concluding this presentation we would like to call attention to the necessity for making careful and detailed observations. It is not necessary for the practical man to measure and count and record his observations as does the technical man but this does not mean that he need not notice the details of size, number, etc. There is nothing that happens so far as the details of the individual plants and small soil surfaces that are of importance. Several thousand detailed plants that comprise the same vegetation on an acre are overgrown and giving way because of low vigor and low competitive strength. Then the acre of crops is exhibiting a decline. If the several thousand plants are existing in vigor, reproducing and out competing the less detailed ones, the acre is on the march. It is similar with the separate several thousand square feet of soil surface comprising the acre. It can't be otherwise. This necessitates attention to the details of size, vigor, reproduction, difference between species of plants, number, etc. of reproductive individual plants and small soil surfaces on the part of the practical man no less than the technical man.

DIGESTIBILITY AND NUTRITIVE VALUE OF IMPORTANT RANGE FORAGE PLANTS

By W. E. Watkins

In June 1949 a project was started to study the digestibility and nutritive value of our range forage. Previous studies on the forages have been made with respect to certain nutrients and elements. The protein of the forages has been studied intensively for southern New Mexico and several outlying areas. The calcium and phosphorus has been studied in the entire state. Carotene and vitamin A has been studied thoroughly in the State College area plus a few spot samplings in other areas.

The objectives of this study are: (1) to determine the digestibility of some of the most important range grasses and browse at different stages of maturity, (2) to determine the calcium, phosphorus, and nitrogen balances using these same forages, and (3) to study the vitamin A problem by means of vitamin A analysis of the blood plasma. This is a long time project and is to run 5 years or more. Wethers are being used in this digestibility study. Special crates or stalls $5\frac{1}{2}$ feet long by 2 feet wide were built so that the sheep could be carefully fed and all the excreta collected. The weights of all the feeds and excreta are recorded and chemical analyses are made. From this data the percent of digestibility of the various food nutrients in the grasses fed can be calculated.

The year-long grazing of ranges is a standard practice in the Southwest. This practice makes livestock production economical, since western stockmen have a natural advantage of cheap range feed. On the average, range feed supports an animal as satisfactorily as other feed which often costs five to ten times as much.

The grasses on much of this western range are said to cure well on the stalk. This means that our dry grasses in the winter and spring still contain a big share of their food value. The chemical analysis and these digestion trials confirm this. The grasses left standing and cured on the stalk even during February usually contain much of this original protein and other nutrients that make them nearly equal to the prairie and native hays. The protein content of black grama for February for 8 consecutive years on this ranch averaged 4.8 percent, while the mesa dropseed averaged 4 percent. Blue grama in other areas averaged from 3 to $3\frac{1}{2}$ percent protein at this time of the year. If a mature dry cow has grass with 6 percent protein she will maintain herself quite well. So in average years the grasses do not fall much below maintenance requirements in southern New Mexico.

One reason for good results on our dry grasses in the winter is that the wintering and leaching of the nutrients from these grasses is usually very slight. There was an exception to this in the fall of 1941 when we had many more late summer and fall rains than usual which helped produce a good crop of grass. The protein and other feed

PRODUCTIVITY AND NUTRITIVE VALUE OF IMPORTANT RANGE FORAGE PLANTS

By W. E. HARRIS

In June 1947 a project was started to study the digestibility and nutritive value of our range forages. Previous studies on the forages have been made with respect to certain nutrients and elements. The protein of the forages has been studied intensively for southern New Mexico and several outlying areas. The calcium and phosphorus has been studied in the entire state. Carotene and vitamin A has been studied thoroughly in the State College area plus a few spot samplings in other areas.

The objectives of this study are: (1) to determine the digestibility of some of the most important range forages and browse at different stages of maturity, (2) to determine the calcium, phosphorus, and nitrogen balances using these same forages, and (3) to study the vitamin A problem by means of vitamin A analysis of the dried plants. This is a long time project and is to run 5 years or more. Weathers are being used in this digestibility study. Special crates or stalls 54 feet long by 3 feet wide were built so that the sheep could be carefully fed and all the excreta collected. The weights of all the feeds and excreta are recorded and chemical analyses are made. From this data the percent of digestibility of the various food nutrients in the forages fed can be calculated.

The year-long grazing of forages in a standard practice in the Southwest. This practice makes livestock production economical, since western stockmen have a natural advantage of cheap range land. On the average, range feed supports an animal as satisfactorily as other feed which often costs five to ten times as much.

The question as much of this western range are said to our well on the state. This means that our dry forages in the winter and spring still contain a big store of their food value. The chemical analysis and these digestion trials confirm this. The forages left standing and cured on the state even during February usually contain much of this original protein and other nutrients that make them nearly equal to the protein and native hay. The protein content of dried grass for February for 8 consecutive years on this ranch averaged 8.8 per cent, while the mean dropped averaged 4 percent. This grass in other areas averaged from 5 to 8 1/2 percent protein at this time of the year. If a mature dry cow has grass with 6 percent protein she will maintain herself quite well. So in average years the forages do not fall much below maintenance requirements in southern New Mexico.

The reason for good results on our dry forages in the winter is that the wintering and feeding of the nutrients from these forages is usually very slight. There was an exception to this in the fall of 1941 when we had many more late snows and fall rains than usual which helped produce a good crop of grass. The protein and other feed

nutrients were washed out of the grass so that the tall grass contained, in some cases, less feeding value than some straws usually have. This situation was accompanied by light-weight calves and lambs at weaning time. Even such depleted forages, with the aid of more supplementary feed than usual, will still bring our livestock through the winter in fair condition.

Another reason we are able to bring our cows through the winter on this dry range grass is that these cows are merely to be maintained, and their requirements are not high.

In the digestibility trials, we are testing for lignin, which is the most woody portion of the plant and cannot be digested even by cattle or sheep. We are obtaining lignin values of around 7 percent for the early-cut and good-quality grasses, while the late-cut and slightly weathered grasses run over 12 percent. Cottonseed hulls contain a little more than 18 percent lignin but they still furnish much feeding value for livestock.

Grasses from several areas of the state have been used in the digestibility study. The first year, blue grama was harvested in Lea County and last year, blue grama was secured in Quay County. Western wheatgrass was collected from San Miguel County. Black grama, mesa dropseed, and tobosa were harvested from this ranch.

These grasses, at maturity, do not normally contain a large amount of protein but the tests show that much of the protein they do contain is being assimilated by the animals. The digestibility of protein found varies from around 30 percent for poorer quality, mature, and weathered grass to near 60 percent for the best quality grass which was harvested near maturity. This compares favorably with the results found for the prairie grasses and native hays.

In closing, I wish to say that with a fair reserve of dry grasses on our ranges through the winter season, the livestock are supplied with a big share of their maintenance needs. This feed contributes little toward fattening or growth, and it must be supplemented as the need arises.

A SUMMARY OF MESQUITE CONTROL TRIALS ON THE COLLEGE RANCH

By J. J. Norris

The fact that mesquite is invading and gradually reducing the productivity of our rangelands has been pointed out on numerous occasions, but it is a fact which cannot be over-emphasized. In many instances this invasion is so slow that it goes on unnoticed until the carrying capacity of the range is greatly impaired and the problem of control has become a job of major proportions. As you may have observed in riding over the College Ranch to this point, we have a lot of mesquite and we recognize that it isn't putting much beef on the calves. Many of you have observed similar situations in other parts of the state and our neighbors in adjoining states as well are facing the problem of mesquite taking over their grasslands.

As a rough example of what mesquite invasion can do to the grass production, we have found that this type of grassland with only a light infestation of mesquite produced 436 pounds of grass per acre. A site similar in all respects except that it had a heavy stand of mesquite produced only 53 pounds of grass per acre. This means that we stand to lose a productivity of around 380 pounds of forage per acre as the light stand of mesquite approaches a heavy stand. Limited studies on rates of mesquite increase have shown that, in areas where mesquite trees are producing seed, the number of plants increased 147 plants per acre in a period of 7 years. In view of these findings we can expect heavy losses in the production of grass forage and declining carrying capacities unless we do something about the mesquite immediately.

Since 1947 we have been testing many of the recently developed herbicidal chemicals to determine their value for controlling mesquite. The majority of these tests have been on a small scale basis with 20 to 60 plants in a test. Results have shown that the esters of 2,4,5-T are superior to other herbicides tested for mesquite work. This chemical at rates of 0.2 percent in water applied as a foliage wetting spray has produced 90 to 100 percent top kills. Complete kills, which means that no sprouting has occurred, have run as high as 94 percent in a few instances although the average is around 40 percent. Lower concentrations than the 0.2 percent have not been effective and higher concentrations have not produced sufficiently greater kills to justify the additional chemical costs.

One important point which has developed from this work is that complete coverage of the foliage on the plant is essential. We find that when portions of branches are not sprayed these parts continue to grow and we have yet to see such a plant die.

Treatments applied on the first and middle of the month from mid-May through August have shown that the best time to spray is early in the growing season. May and June treatments have produced up to

75 percent complete kills. As the season progressed, the percentage kill decreased to near zero in August. These results indicate that treatment should be carried out at about the time the plants reach the full leaf stage but before the leaves begin to mature and harden.

Some rather striking differences from year to year have shown up apparently as a result of rainfall differences. Some of our best mesquite kills followed treatments in 1949 when the site received 2.86 inches of precipitation between January and the spraying date in May. During 1950 the total precipitation during the same period was only 0.16 inches and all treatments produced poor results. These differences are not surprising since all experiments with these herbicidal chemicals have shown that best results occur when plants are in a condition of rapid and vigorous growth at the time of treatment. To us it means that we won't plan to do much spraying after a dry winter and spring, but will attempt to concentrate on mesquite control work in the more favorable years.

The addition of various types of oil to 2,4,5-T and water spray mixtures have been tested. Results to date have been variable although there are some indications that the addition of small amounts of non-toxic oils is beneficial. Toxic oils such as diesel or kerosene appear to cause leaves to drop before the 2,4,5-T has had time for complete action. Continued studies along this line are planned to determine suitable spray mixtures for our conditions. We have also been working on stem base treatments of both cut and uncut stems but so far the results have not been encouraging. One small series of stem base treatments applied in mid-winter when the plants were dormant looked good enough for further trials. This type of treatment may become especially valuable since the work can be carried on in what is normally a rather slack season in the ranch work.

Limited large scale treatments have been applied during the past two years. These treatments were confined to ground spraying operations using a pick-up mounted spray machine. This type of operation appears to be quite effective on light to medium stands, but with heavy stands too much time is required in spraying individual plants and it is often difficult to drive through such areas. In these instances, airplane spraying is the only answer. Five blocks of about 4 acres each were treated in 1950 and top kills of around 90 percent resulted. Sprouting, however, was heavy and recent checks showed a complete kill of only about 30 percent. These rather poor results were due, in part at least, to the extremely dry spring of 1950. A block of 33.5 acres containing 125 plants per acre was treated in June of this year using 0.25 percent 2,4,5-T in water and applying 7.5 gallons of the spray mixture per acre. Cost of the chemical was 46 cents per acre and with a pick-up and three-man crew, the operation required 0.9 man hours and 0.3 equipment hours per acre. Total estimated costs are from \$1.50 to \$1.75 per acre depending on labor costs and charges for the equipment. Recent checks showed top kill approaching 100 percent, complete kills ran to 68 percent. About 11 percent of the plants were sprouting and the remaining 23 percent

were recorded as complete or partial misses. These results look good right now but are tentative only since sprouting has been observed for as long as three years after treatment.

In view of the erratic results obtained from chemical spray treatments, we continue to emphasize the desirability of working on light stands of small mesquite plants with mechanical methods. The grubbing hoe still appears to be the most effective and economical method in this respect and we hand grubbed a 200 acre block containing $6\frac{1}{2}$ plants per acre this year. This operation required 0.2 man hours per acre. Some checks on a 400 acre area grubbed last year showed 8 percent of the plants missed and 7 percent resprouting as a result of shallow grubbing. These findings show the need for care in locating all of the small plants and grubbing sufficiently deep to remove the potential sprouting tissue. In both of these areas the large plants were left for spot cleanup with sprays. Such a practice appears to be an economical means of combating the invasion of mesquite in its early stages. When mesquite forms a heavy stand with many large plants then hand grubbing is out of the question because of the labor costs, however, it may still be a valuable follow-up method for use on sprayed areas.

In summation, we believe that 2,4,5-T offers considerable promise for controlling mesquite. To date our findings indicate that around 0.2 percent of the 2,4,5-T in water applied as a foliage wetting spray will do a good job. It appears highly important that all leaves on a plant be covered with the spray if maximum effect is to be obtained. The best season to treat is in May or June at about the time the trees come into full leaf. Better results have followed treatments during years with good rainfall in the spring and we recommend that the work be concentrated during such years. Hand grubbing is the best method for eradicating invading stands of small mesquite and much attention should be paid to this type of work.

CURRENT CONDITIONS AND DROUGHT MANAGEMENT ON THE JORNADA

By F. N. Ares

The 1951 Drought

On our Ranch Day tour of the Jornada this year you will see only a very small portion of the area. As far as current conditions on the ground go, you are seeing a fairly good sample of the whole 190,000 acres. Unlike our neighbors to the west and south, we were almost completely missed by the rains this year. What moisture we did have was so scanty and poorly timed that it accomplished little in the way of forage growth. We can only hope that from here on we will obtain sufficient fall and winter moisture to prevent further loss of our good perennial grasses; also to produce some winter and spring weeds to tide us over until next summer.

We have already lost some of our valuable black grama grass in our ungrazed enclosures as well as on grazed range. This is inevitable in a drought of such severity and duration as the present one. However, we are confident that this loss will be held to a minimum over most of the range because of the relatively good vigor of this grass. This is the pay-off for a long period of conservative grazing use, a plan of management based on the maintenance requirements of the forage plants. This is expressed in such terms as proper stocking, good distribution of cattle over the range, and seasonal use of the range.

Rainfall this calendar year totals 2.44 inches up to August 31. About half of this, 1.23 inches, has fallen during the summer growing season and could be termed only partially effective, the remainder being from a number of light showers up to the end of June, none of which was sufficient to promote any growth of forage. This rainfall so far represents only about 27 percent of the average annual and only 25 percent of the average growing season rainfall. At this writing, therefore, 1951 as a drought year promises to be on a par with or even worse than 1917 and 1934.

The Present Drought Cycle

Some say we are in a 10-year drought, others declare it to be part of a 30-year drought, and some even go so far as to say that our current drought has already lasted nearly 300 years. The Jornada climatic records only extend back 36 years and while we do not feel competent to express an opinion about the 30- or 300-year drought cycles, we can definitely point to a 10-year drought, including the present year. There is little doubt at present that 1951 will fit nicely into the drought pattern shown on the accompanying chart although it of course is not included.

CURRENT CONDITIONS AND PROSPECT MANAGEMENT ON THE JORNADA

By F. M. Allen

The 1931 Drought

On our Ranch Day four of the Jornada this year you will see only a very small portion of the area. As far as current conditions on the ground go, you are seeing a fairly good sample of the whole 190,000 acres. Unlike our neighbors to the west and south, we were almost completely missed by the rain this year. What remains we did have was no sandy and poorly timed that it accomplished little in the way of forage growth. We can only hope that from here on we will obtain sufficient fall and winter moisture to prevent further loss of our good perennial grasses; also to produce some winter and spring weeds to tide us over until next summer.

We have already lost some of our valuable black grama areas in our grazed areas as well as on grazed ranges. This is inevitable in a drought of such severity and duration as the present one. However, we are confident that this loss will be held to a minimum over most of the range because of the relatively good vigor of this grama. This is the pay-off for a long period of conservative grazing use, a plan of management based on the maintenance requirements of the forage plants. This is expressed in such terms as proper stocking, good distribution of cattle over the range, and seasonal use of the range.

Finally this calendar year totals 8.44 inches up to August 21. About half of this, 4.22 inches, has fallen during the summer growing season and could be termed only partially effective. The calendar has long from a number of light showers up to the end of June, none of which was sufficient to promote any growth of forage. This rainfall so far represents only about 27 percent of the average annual and only 25 percent of the average growing season rainfall. At this writing, therefore, 1931 as a drought year promises to be on a par with or even worse than 1917 and 1934.

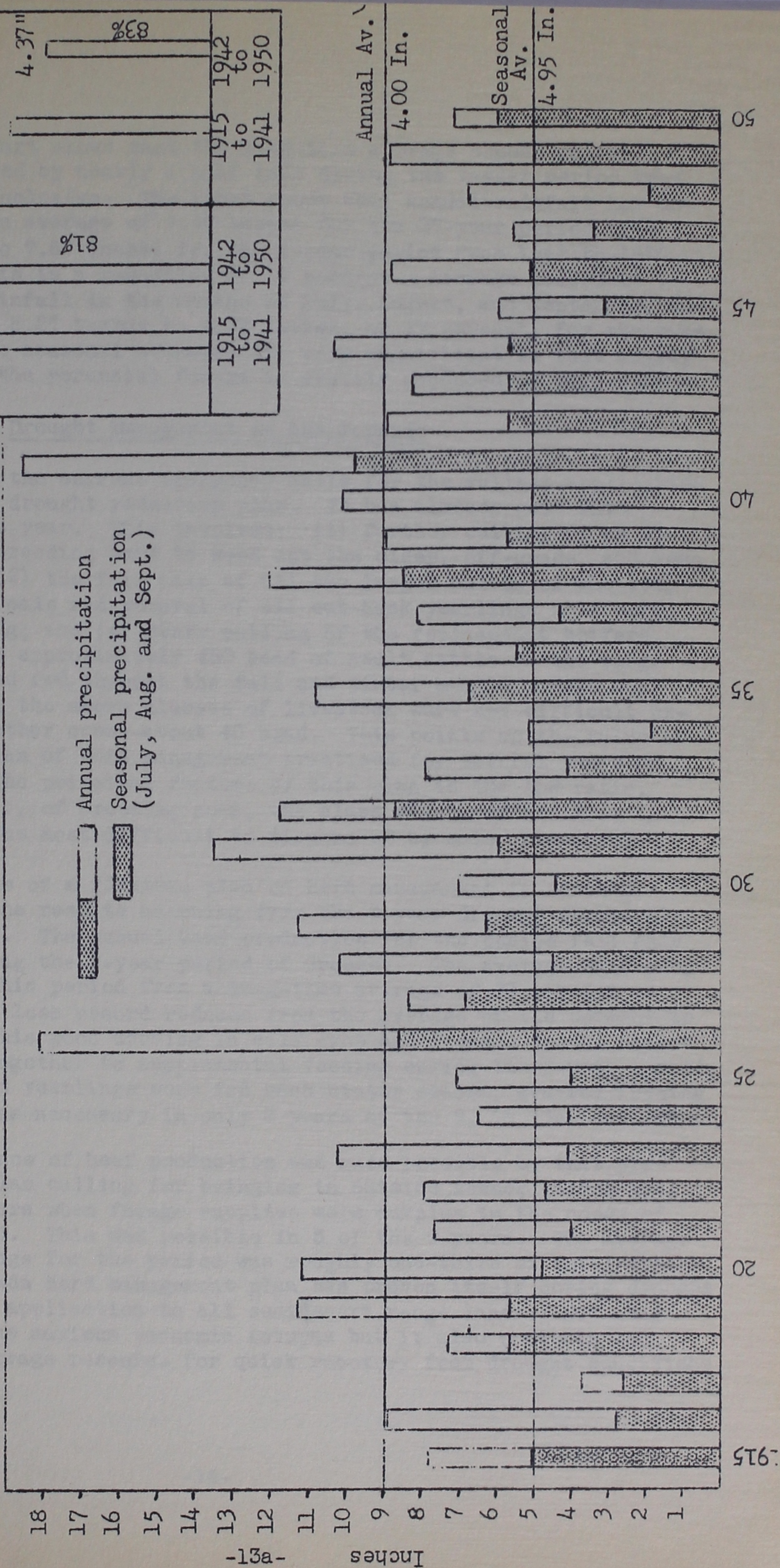
The Present Drought Cycle

Some say we are in a 10-year drought, others declare it to be part of a 30-year drought, and some even go as far as to say that our current drought has already lasted nearly 800 years. The Jornada cattle records only extend back 35 years and while we do not feel competent to express an opinion about the 30- or 800-year drought cycles, we can definitely point to a 10-year drought, including the present year. There is little doubt at present that 1931 will fit nicely into the drought pattern shown on the accompanying chart although it of course is not included.

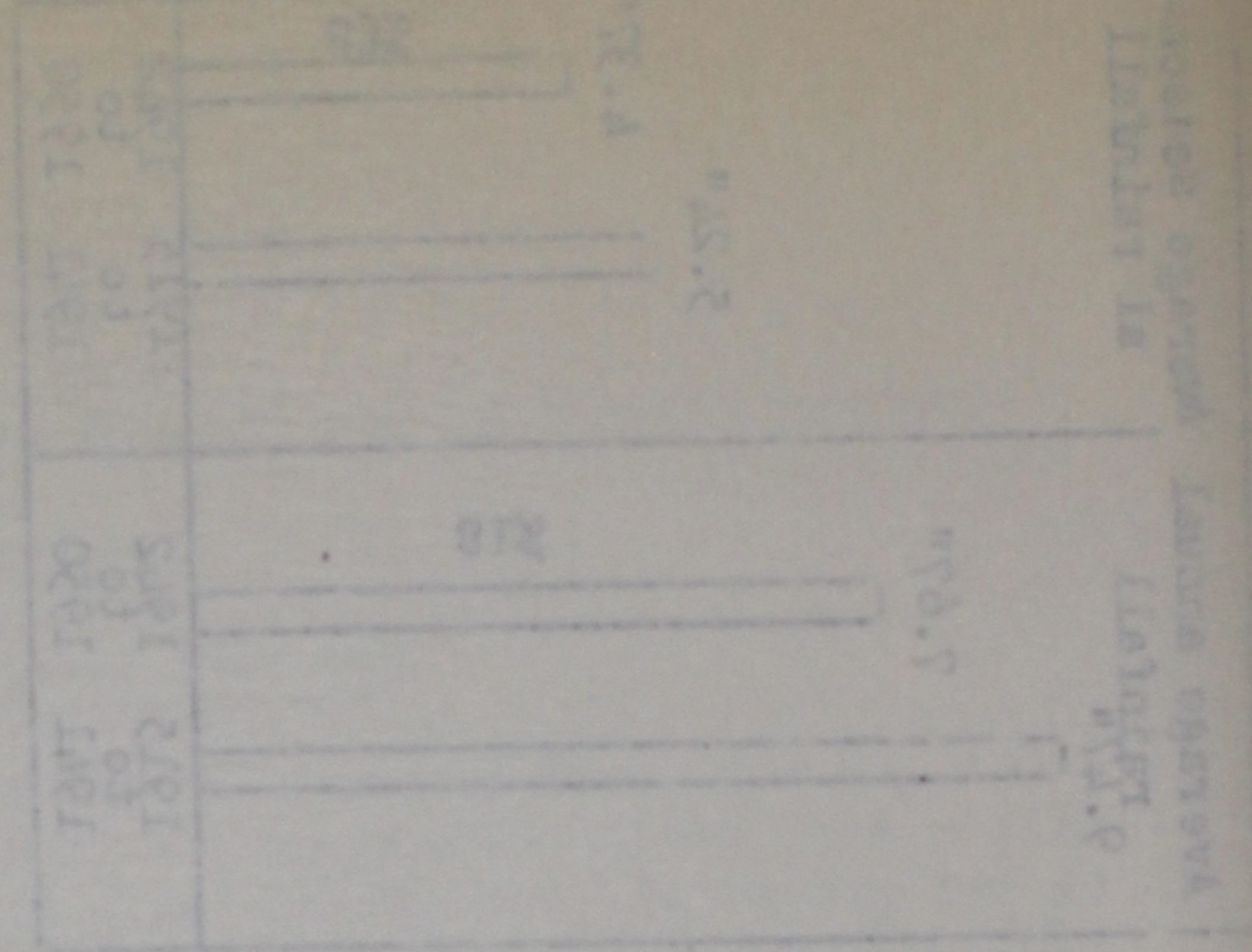
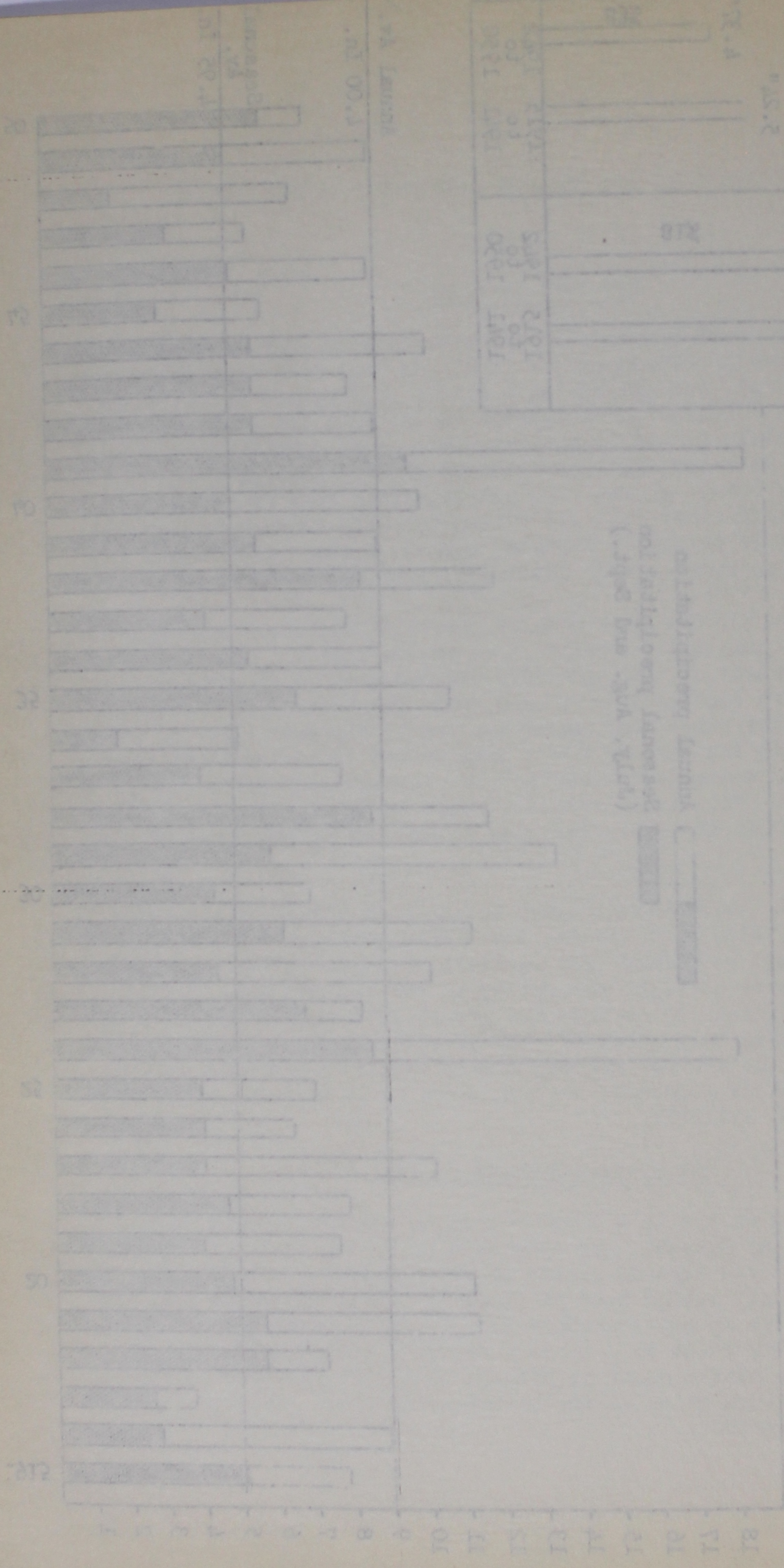
Average annual rainfall 9.47"

Average seasonal rainfall 4.37"

36-YEAR AVERAGE ANNUAL AND SEASONAL RAINFALL
JORNADA EXPERIMENTAL RANGE
1915 - 1950



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 1000.



This chart shows that the long-time average annual rainfall has been reduced by nearly a half inch during the 9-year period from 1942 to 1950 inclusive. The inset shows that annual rainfall has decreased from an average of 9.47 inches for the 27-year period from 1915 to 1941 to 7.67 inches for the 9-year period from 1942 to 1950 inclusive. This is a reduction of 19 percent. Average seasonal rainfall or rainfall in the months of July, August, and September, has decreased from 5.27 inches to 4.37 inches, or 17 percent, for the same periods. These seasonal averages are very significant in that nearly 90 percent of the perennial forage is usually produced in this period.

Drought Management on the Jornada

Meeting the current emergency calls for the fullest application of the Jornada drought reduction plan. It has already gone into effect for this year. This involves: (1) further culling of an already reduced breeding herd to weed out the older, off-grade, and less thrifty cows; (2) the fall sale of all the larger calves of the 1951 calf crop; (3) sale and removal of all cut-back yearlings held over from last spring; and (4) heavy culling of the replacement heifers. This will leave approximately 450 head of adult cattle on the range to be grazed and fed through the fall and winter months. Sale and disposal of all the above classes of livestock were not difficult except for the mother cows--about 40 head. This points up the value of the flexible plan of herd management practiced for several years on the Jornada. The principal feature of this plan is the low ratio, about 56 percent, of breeding cows, the class which suffers most in a drought and the most difficult to dispose of by sale or removal.

The value of a flexible plan of herd management is further emphasized by the results accruing from the 9-year drought period already discussed. The annual beef production for the period fell only 23 percent during the 9-year period of drought. The average calf crop was raised in this period from a long-time average of 73 percent to 87 percent, the loss record reduced from the average of 1.6 percent to 1.1 percent. This good showing in calf crop and reduced losses cannot be credited altogether to supplemental feeding during the 9-year period. While calves and yearlings were fed each winter season, general feeding of all cattle was necessary in only 2 years of the 9, in 1948 and 1950.

Maintenance of beef production was made possible by that provision of the plan calling for bringing in outside feeder calves and yearlings in years when forage supplies were surplus to the needs of the reduced herd. This was possible in 5 of the 9 years. The average ratio of yearlings for the period was roughly one-third of total stocking. This Jornada herd management plan has proven itself during drought to be worthy of application to all semidesert range lands. Not only does it yield the maximum economic returns but it also protects and maintains the forage resource for quick recovery from drought conditions.

This chart shows that the long-time average annual rainfall has been reduced by nearly a half inch during the 3-year period from 1942 to 1950 inclusive. The inset shows that annual rainfall has decreased from an average of 9.47 inches for the 3-year period from 1942 to 1944 to 7.52 inches for the 3-year period from 1945 to 1950 inclusive. This is a reduction of 19 percent. Average seasonal rainfall or rainfall in the months of July, August, and September, has decreased from 5.27 inches to 4.37 inches, or 17 percent, for the same periods. These seasonal averages are very significant in that nearly 50 percent of the perennial forage is usually produced in this period.

Drought Management on the Tornado

Meeting the current emergency calls for the District application of the Tornado drought reduction plan. It has already been in effect for this year. This involves: (1) further cutting of an already reduced breeding herd to meet out the class, all classes, and less family cows; (2) the fall sale of all the calves born in the 1951 calf crop; (3) sale and removal of all out-back yearlings held over from last spring; and (4) heavy cutting of the permanent herd. This will leave approximately 450 head of adult cattle on the range to be grazed and fed through the fall and winter months. This and disposal of all the above classes of livestock were not difficult except for the action cows—about 40 head. This points up the value of the flexible plan of herd management provided for study years on the Tornado. The principal feature of this plan is the low ratio, about 25 percent, of breeding cows, the class which suffers most in a drought and the most difficult to dispose of by sale or removal.

The value of a flexible plan of herd management is further emphasized by the results accruing from the 3-year drought period already discussed. The annual beef production for the period fell only 23 percent during the 3-year period of drought. The average calf crop was raised in this period from a long-time average of 75 percent to 57 percent. The loss years reduced from the average of 1.6 percent to 1.1 percent. This good showing in calf crop and reduced losses cannot be credited altogether to supplemented feeding during the 3-year period. While calves and yearlings were fed each winter season, general feeding of all cattle was necessary in only 2 years of the 3, in 1948 and 1950.

Maintenance of beef production was made possible by that provision of the plan calling for placement in outside feeder calves and yearlings in years when forage supplies were ample to the needs of the reduced herd. This was possible in 2 of the 3 years. The average ratio of yearlings for the period was roughly one-third of total stocking. This Tornado herd management plan has proven itself during drought to be worthy of application to all semiarid range lands. Not only does it yield the maximum economic returns but it also protects and maintains the forage resources for quick recovery from drought conditions.

MEASURING RANGE CONDITION AND TREND

By C. Kenneth Pearse

A common definition of range condition is "the state of health of a range." Like health, range condition is easily described in general terms. In some cases it may not be necessary to go beyond a general evaluation of range condition. Thus, Valentine has pointed out that stockmen can recognize signs of good or poor condition on their ranges and can profit by them.

When it is necessary to evaluate condition critically or to determine whether a range is improving or deteriorating, quantitative data are needed. While it is satisfactory to describe a person's health as "good" so long as he is feeling fine, medical doctors usually must go beyond the statement that a patient is in good or poor health. They supplement these general terms by measurements of temperature, blood pressure, pulse rate, and by X-ray photographs. In the same way, range men need reliable measurements and records to supplement and provide a basis for their judgment of range condition.

To meet this need the "3-Step Method" has been developed. It consists of:

- (1) Making detailed measurements of the vegetation and soil cover on a permanently located transect line.
- (2) Classifying the data obtained in Step 1 and rating the condition on a graduated scale.
- (3) A photographic record of the site.

We have used the 3-Step Method at this stop and would like to go through the procedure with you. We first established six 100-foot transect lines. Three iron stakes are used to mark each of these so that we can return to the exact spot. At one-foot intervals along each line we have made observations of the vegetation or other ground cover which occurs within a 3/4-inch loop. By tying our observation to this small area we can make sure that all observers are looking at the same thing. The average of the six 100-foot lines for this location is as follows:

| | | |
|---------------|-----------------------|----------------------|
| Black grama | occurred in 7 loops) | |
| Mesa dropseed | " " 1 loop) | Total vegetation - 8 |
| Weeds | " as a trace) | |
| Rock | " in 1 loop | |
| Litter | " " 15 loops | |
| Bare soil | " " 76 " | |

Classification and interpretation of these data cannot be accomplished without careful judgment. To focus attention on the important points and to assure that all will judge the same things, a score card similar to that used in animal judging contests is used. These score cards vary with the type of vegetation. Usually three factors are

MEASURING RANGE CONDITION AND TYPE

By G. Kenneth Peters

A common definition of range condition is "the state of health of a range." This healthy range condition is easily described in general terms. In some cases it may not be necessary to go beyond a general evaluation of range condition. Thus, condition has pointed out that stockman can recognize signs of good or poor condition on their ranges and can profit by them.

When it is necessary to evaluate condition critically on a basis of whether a range is improving or deteriorating, quantitative data are needed. While it is satisfactory to describe a range's health as "good" so long as he is feeling fine, medical doctors usually must go beyond the statement that a patient is in good or poor health. They supplement these general terms by measurements of temperature, blood pressure, pulse rate, and by X-ray photographs. In the same way, range men need reliable measurements and records to supplement and provide a basis for their judgment of range condition.

To meet this need the "5-Step Method" has been developed. It consists of:

- (1) Making detailed measurements of the vegetation and soil cover on a permanently located transect line
- (2) Classifying the data obtained in Step 1 and rating the condition on a graduated scale
- (3) A photographic record of the site

We have used the 5-Step Method at this stop and will live to go through the procedure with you. The first established six 100-foot transect lines. These lines are used to mark each of these as they we can return to the exact spot. At one-foot intervals along each line we have made observations of the vegetation on other ground cover which occurs within a 5-foot foot. By using our observation to this small area we can make sure that all observers are looking at the same thing. The average of the six 100-foot lines for this location is as follows:

| | |
|-------------|---------------------|
| Black grama | occurred in 5 lines |
| Woods | " |
| Rock | " |
| Litter | " |
| Bare soil | " |
| | in 1 line |
| | in 2 lines |
| | in 3 lines |
| | in 4 lines |
| | in 5 lines |
| | in 6 lines |
| | in 7 lines |
| | in 8 lines |
| | in 9 lines |
| | in 10 lines |

Classification and interpretation of these data cannot be accomplished without careful judgment. To learn attention on this important points and to assure that all will judge the same things, a score card similar to that used in animal judging contests is used. These score cards vary with the type of vegetation. Usually three factors are

considered in rating the vegetation and each is given a total of 15 points for a perfect score. The first factor is the density of desirable forage plants taken directly from the loop measurements. Here the total forage density of 8 is about two-thirds of the maximum density which can be expected on black grama ranges. We therefore give density a rating of 10.

The second item to rate is the composition of the vegetation, or the proportions of the various plants present. This is also taken directly from the loop measurements. But this cannot be done entirely mechanically since the indicator value of a plant depends somewhat on where it grows and what other species are present. Here the vegetation is composed predominantly of desirable grasses with some worthless weeds recorded on the line and a few others which occur in the general area, but happen to have missed the loop. The score card gives descriptions of various mixtures of plants and suggests ratings for each. On this basis, the rating here is about 11 out of a possible 15.

The third rated element is vigor of the desirable grasses. This is difficult to measure but is related to the height and number of seed stalks, the size of clumps, the color, and the amount of reproduction or spread. Here the average height of the flower stalks is 18 inches, or near the maximum for black grama. However, the plants are quite small and lacking in reproductive sets. Accordingly, vigor is rated at 8. The total of the three elements is 29, which out of a possible 45, would classify the vegetation at this site as "high-fair."

The condition of the soil is also rated but experience has shown that soil ratings should be kept separate from vegetative ratings. Three soil items have been recognized as important in describing range soil condition. The total ground cover which protects the soil from erosion is made up of the vegetation, the litter, and larger rocks. This is determined from the loop measurements and in this case is only 24 out of each 100 loops, justifying a rating, according to the score card, of 4.

The second soil element is the evidence of excessive soil movement by wind or water. Here the bare places between the plants are rather conspicuous, and this item is rated 10.

The final element is the ease with which water can percolate into and through the soil mantle. On this site the soil is loose and sandy, and justifies a rating of about 11.

The total of 24 of a possible rating of 45 for soil elements is "fair."

The final step is the taking of photographs to provide a permanent record of what is on the ground. A general view is taken along each transect line and a closeup is taken of a marked plot 3 foot square. Such photographs have proven exceptionally valuable since they leave no room for personal bias or memory. They are, however, qualitative only; one cannot express what they show in terms of figures.

considered in making the vegetation and soil is given a total of 15 points for a perfect score. The final factor is the density of leafy plants taken directly from the loop measurements. The total forage density of 5 is about two-thirds of the maximum density which can be expected on black grass ranges. We therefore give density a rating of 10.

The second item to rate is the composition of the vegetation, or the proportions of the various plants present. This is also taken directly from the loop measurements. But this cannot be done entirely mechanically since the relative value of a plant depends somewhat on where it grows and what other species are present. Here the vegetation is composed predominantly of desirable species with some undesirable weeds recorded on the line and a few others taken over in the general area, but happen to have missed the loop. The score and gives the proportions of various mixtures of plants and assigns ratings for each. On this basis, the rating here is about 10 out of a possible 15.

The third rated element is that of the distribution of plants. This is difficult to measure but is related to the height and number of seed stalks, the size of clumps, the color, and the amount of bare ground or exposed. For the average height of the black grass is 18 inches, or near the maximum for black grass. However, the plants are quite well and lacking in reproductive vigor. Accordingly, a rating of 8. The total of the three elements is 23, which out of a possible 40, would classify the vegetation as this site as "highly fair."

The condition of the soil is also rated but requires a few more steps than soil ratings should be kept separate from vegetative ratings. Three soil items have been recognized as important in describing range soil conditions. The total graded cover which protects the soil from erosion is made up of the vegetation, the litter, and bare rock. This is determined from the loop measurements and in this case is only 24 out of each 100 loops, justifying a rating, according to the score card, of 4.

The second soil element is the surface of erodible soil exposed by wind or water. Here the bare areas between the plants are rather conspicuous, and this item is rated 10.

The final element in the case with which water was present is that and through the soil mantle. On this site the soil is loose and sandy, and justifies a rating of about 11.

The total of 34 of a possible rating of 45 for soil elements is "fair."

The final step in the taking of photographs to provide a permanent record of what is on the ground. A general view is taken along each transect line and a close-up is taken of a marked plot 3 feet square. Such photographs have proven extremely valuable since they leave no room for personal bias or memory. They are, however, qualitative only and cannot express what they show in terms of quantity.

The 3-Step Method is an attempt to measure rather than estimate. It strives to be specific rather than general. While we have not and probably cannot get away from judgment in interpretation, we have, by use of this method, obtained measurements of important factors at permanently located points. These can be repeated at later dates. Tests show that different men can repeat the measurements with little differences in results. Other tests have shown that the 3-Step Method is rapid and simple enough to be put into effect on grazing allotments by the local ranger and the permittee working together. The complete rating described here, including all three steps, could be done by 2 men in less than 2 hours.

At other points along the Ranch Day route we have made ratings by the 3-Step Method. The results are summarized as follows:

| <u>Loop Observations</u> | <u>Site A</u> | <u>Site B</u> |
|----------------------------|---------------|---------------|
| Black grama | 2 | 11 |
| Mesa dropseed | - | 1 |
| Weeds (undesirable) | 1 | - |
| Litter | 9 | 31 |
| Rock | - | 2 |
| Bare soil | 88 | 55 |
| Height of black grama | 18 in. | 20+ in. |
| <u>Ratings</u> | | |
| Total forage density | 3 | 14 |
| Composition | 5 | 15 |
| Vigor of desirable grasses | 5 | 9 |
| Total Vegetation Rating | 13 = Poor | 38 = Good |
| Total ground cover | 2 | 7 |
| Current erosion | 6 | 11 |
| Permeability to water | 7 | 11 |
| Total Soil Rating | 15 = Poor | 29 = Fair |

There can be no question that the condition of the three locations are different and that the method reflects these differences. At Site B, for example, we have many more loops occupied by grass or litter and less bare ground than at either of the other locations. Undesirable plants are lacking on the lines and quite inconspicuous on the area generally. Measurements show the black grama seed stalk average more than 20 inches in height, and the clumps are large and vigorous with strong reproduction. All of these measurements are reflected in the rating which is "good."

The 3-Step Method is an attempt to measure rather than estimate. It arrives to be specific rather than general. While we have not and probably cannot get away from judgment in interpretation, we have, by use of this method, obtained measurements of important factors at previously located points. These can be repeated at later dates. Tests show that different men can repeat the measurements with little difference in results. Other tests have shown that the 3-Step Method is rapid and simple enough to be put into effect on grazing allotments by the local ranger and the permitted working together. The complete rating described here, including all three steps, could be done by 2 men in less than 2 hours.

At other points along the Ranch Day route we have made ratings by the 3-Step Method. The results are summarized as follows:

| Loop Observations | | Site A | Site B |
|----------------------------|-----------|-----------|--------|
| Black grass | 2 | 11 | |
| Wheat dropped | - | 1 | |
| Woods (undesirable) | 1 | - | |
| Litter | 9 | 31 | |
| Rock | - | 8 | |
| Barb soil | 88 | 88 | |
| Height of black grass | 18 in. | 20-22 in. | |
| Rating | | Site A | Site B |
| Total forage density | 3 | 14 | |
| Composition | 5 | 10 | |
| Vigor of desirable grasses | 3 | 9 | |
| Total Vegetation Rating | 15 = Poor | 36 = Good | |
| Total ground cover | 2 | 7 | |
| Current erosion | 8 | 11 | |
| Permeability to water | 7 | 11 | |
| Total Soil Rating | 15 = Poor | 39 = Fair | |

There can be no question that the condition of the three locations are different and that the ratings reflect these differences. At Site B, for example, we have many more spots occupied by grass or litter and less bare ground than at either of the other locations. Undesirable plants are lacking on the line and only inconspicuous ones are generally. Measurements show the black grass seed stalk average more than 20 inches in height, and the clumps are large and vigorous with strong reproduction. All of these measurements are reflected in the rating which is "Good."

If repeat measurements made some years hence showed differences such as we have just noted between these locations, there could be little argument as to the change in condition. Thus, if in 1956 we resampled Site B, now rated "good", and obtained a fair rating such as we obtained at the site we first examined, we should be quite concerned. Conversely, if during the next 5 years those spots which now rate only "fair" show the density composition, vigor, and soil stability that we have recorded here, we would conclude that our rate of stocking, season of use, and general management of the range were satisfactory.

12. report measurements made over years have shown little
change such as we have just noted between these locations, there
could be little argument as to the change in conditions. Thus, in
1935 we measured Site A, now rated "good", and obtained a fair
rating such as we obtained at the site we first examined, we should
be quite concerned. Conversely, if during the next 5 years there
were which now rate only "fair" show the degree of competition, there
and will stability that we have reported here, we would conclude that
the rate of stocking, season of use, and general management of the
range were satisfactory.

PRESENT OUTLOOK FOR PRACTICAL MESQUITE CONTROL

By George E. Glendenning

The mesquite control problem seems to come up for a major share of the discussion every year at this Ranch Day program. This is no doubt an indication of the amount of rancher interest and is logical in view of the size and importance of the mesquite problem in the Southwest.

The purpose of this talk is to try to give you an honest appraisal as to how we stand with respect to methods for controlling this plant. Owing to the many complex factors involved, it is dangerous to generalize concerning the present status of mesquite control and it would be even more foolish to prophesy regarding future developments in this field.

It is safe and logical, however, to summarize the tools or methods now available and consider their various advantages and limitations.

Hand grubbing.--Although not a glamorous method, hand grubbing is mentioned first. This method is not only highly effective but, if done in time, is practical and economical. Mesquite spreads only from seed and if young plants are grubbed out as soon as they are large enough to be found, and before they are producing seed, development of stands of mesquite just won't take place. There are many ranches in New Mexico and Arizona where hand grubbing could be used effectively; and we believe that it should be more widely used.

Mechanical grubbing.--A good deal of mesquite has been killed by uprooting with bulldozers, stingers, and more recently by cabling and chaining. On some ranches use of very large root cutters or root plows has been employed. On high-production ranges where increased grazing capacity will liquidate the high cost of mechanical control these methods have been widely used. Very few ranchers located west of the Pecos River have felt that they could afford to attack mesquite by mechanical methods. In addition to costs which may run from \$5 to \$15 or more per acre, some plants are always missed, and soil disturbance created by mechanical control commonly results in a great number of new mesquite seedlings; so that the job usually must be repeated within a few years.

Chemical control.--Greatest promise for control of established stands of mesquite on low-capacity land no doubt lies in the use of a selective foliage spray that can be quickly applied over large areas at low cost. This is almost certain to be the case on the multiple-stemmed western honey mesquite of southern New Mexico where mechanical grubbing is out of reason.

INSECT CONTROL FOR PRACTICAL AGRICULTURE

By George E. Cline

The insect control problem seems to come up for a major share of the discussion every year at this season. This is no doubt an indication of the amount of interest and its logical view of the size and importance of the insect problem in the Southwest.

The purpose of this talk is to try to give you an honest appraisal as to how we stand with respect to methods for controlling this pest. Owing to the many complex factors involved, it is dangerous to generalize concerning the present status of insect control and it would be even more foolish to prophesy regarding future developments in this field.

It is safe and logical, however, to summarize the tools or methods now available and consider their various advantages and limitations.

Hand grubbing.—Although not a systematic method, hand grubbing is mentioned first. This method is not only highly effective but, if done in time, is practical and economical. Insecticide sprays only from seed and if young plants are killed out as soon as they are large enough to be found, and before they are producing seed, development of stands of insects just won't take place. There are many times in New Mexico and Arizona where hand grubbing could be used effectively and we believe that it should be more widely used.

Mechanical grubbing.—A good deal of meadow has been killed by grubbing with bulldozers, tractors, and more recently by chaining and chaining. On some ranches use of very large root cutters or root plows has been employed. On this method the most of a mechanical control system capacity will likely be the most of a mechanical control system. Many low methods have been widely used. Very low methods of the Pecos River have left that they could afford to attack meadows by mechanical methods. In addition to seeds which are from 2 to 4 1/2 or more per acre, some plants are always present, and soil disturbance created by mechanical control completely results in a great number of new meadows being created so that the job usually must be repeated within a few years.

Chemical control.—Greatest promise for control of established stands of meadows on low-capacity land no doubt lies in the use of a selective foliage spray that can be selectively applied over large areas at low cost. This is almost certain to be the case on the meadows of western honey meadows of Southern New Mexico where mechanical grubbing is out of reason.

Cooperation with many commercial chemical companies has made it possible to test a great variety of herbicidal preparations. These tests show conclusively that 2,4,5-T is the most effective selective herbicide now available. Unfortunately 2,4-D, which costs less than half as much as 2,4,5-T, just won't kill mesquite.

Recommended dosages of 2,4,5-T can be sprayed by airplane at a total cost of about \$3 per acre if large areas are involved and landing strips are conveniently located. So far airplane applications of 2,4,5-T have not produced a 100-percent kill of mesquite but it is now a demonstrated fact that this method will give effective control of mesquite under ideal conditions. Top-kills of 90 to 95 percent and complete kills of up to 60 percent of the trees in the stands have been obtained on some extensive plots in Texas. The expenditure of \$3 per acre on some range land may be questioned but ranchers in North Texas who have spent up to \$15 or more per acre for mechanical control of mesquite feel that airplane spraying gives the best control for the money, and are signing up for this work. PMA benefit payments are being made and there is no doubt that the amount of airplane spraying on mesquite will expand rapidly in all areas where it will produce an effective degree of control.

Limitations in chemical control.--Unfortunately mesquites growing under different environmental conditions do not all make the same response when treated with 2,4,5-T. Present indications are that best kills are obtained on trees that have been growing under conditions of abundant moisture. In contrast, trees on sites that have been dry during the past 4 or 5 years appear to be much less affected by the 2,4,5-T. In laboratory tests we demonstrated that mesquite seedlings grown with abundant water are more susceptible than those grown with a reduced supply. However, in field tests in which we irrigated mature trees for 6 weeks prior to spraying and obtained a lush growth we did not raise the effectiveness of the kill, thus appearing to indicate that trees which have been making rapid growth for a short time only are not necessarily in a suitable state for spraying.

This year we sprayed forty-three 5-acre test plots at three sites in southern Arizona. Esters and amines of 2,4,5-T were applied by airplane at 3/4 pounds acid equivalent per acre in 5, 10, and 20 gallons of carrier containing varying proportions of diesel oil and nontoxic oil and water. Spraying was done at full-leaf stage in May. Practically complete defoliation was obtained. Results cannot be finally evaluated until next summer. However, it is already clear that many of the trees which were 100 percent defoliated by the spray are not dead now and are likely to be alive next year.

Oiling of individual trees.--The practicability of treating individual mesquite trees with diesel oil has been pointed out on many previous occasions and is worthy of being mentioned again at this time. One pint of diesel oil can be applied around the base of a mesquite tree for about \$.045. On the moderately loose sandy loam soils of

Cooperation with many commercial chemical companies has made it possible to test a great variety of herbicidal preparations. These tests show conclusively that 2,4-D is the most effective selective herbicide now available. Unfortunately 2,4-D, which costs less than half as much as 2,4,5-T, just won't kill weeds.

Recommended dosage of 2,4-D can be sprayed by airplane at a total cost of about \$2 per acre if large areas are sprayed and land-lab strips are conveniently located. So far airplane applications of 2,4-D have not produced a 100-percent kill of weeds but it is now demonstrated that this method will give effective control of weeds under ideal conditions. For kills of 99 to 95 percent and complete kills of up to 60 percent of the weeds in the stands have been obtained on some extensive fields in Texas. The expenditure of \$2 per acre on some large land may be considered but treatment in North Texas who have spent up to \$15 an acre for chemical control of weeds feel that airplane spraying gives the best control for the money, and are sticking up for this work. The benefit of spraying before weeds and there is no doubt that the amount of spraying required on weeds will expand rapidly in all areas where it will produce an effective degree of control.

Limitations in chemical control. Unfortunately weeds grow under different environmental conditions in not all areas the same response when treated with 2,4-D. Present indications are that best kills are obtained on trees that have been growing under conditions of abundant moisture. In contrast, trees on sites that have been dry during the past 4 or 5 years appear to be much less affected by the 2,4-D. In laboratory tests we demonstrated that mesquite seedlings grown with abundant water are more susceptible than those grown with a reduced supply. However, in field tests in which we treated mesquite trees for 6 weeks prior to spraying and obtained a 100 percent kill of trees the effectiveness of the kill, thus appearing to indicate that trees which have been making rapid growth for a short time only are not necessarily in a suitable state for spraying.

This year we sprayed forty-three 5-acre test plots at three sites in southern Arizona. Waters had an average of 2,4-D was applied by airplane at 5/4 pounds solid equivalent per acre in 8, 12, and 20 gallons of carrier containing varying proportions of diesel oil and water. Oil and water. Spraying was done at full-rate stage in May. Practically complete defoliation was obtained. Weeds could be easily eliminated until next summer. However, it is already clear that many of the trees which were 100 percent defoliated by the spray are not dead now and are likely to be alive next year.

Timing of herbicide spray. The practicability of treating individual mesquite trees with diesel oil has been pointed out on many previous occasions and is worthy of being mentioned again at this time. One pint of diesel oil can be applied around the base of a mesquite tree for about \$.045. On the moderately large sandy loam soils of

southern Arizona we have consistently obtained kills ranging from 85 to 95 percent with diesel oil. This is a practical method for use on scattered stands of the tree form of mesquite.

The ultimate goal of research is to develop a spraying technique by which mesquites can be killed or effectively controlled with certainty on all sites despite unfavorable growing conditions. However, at this time it appears that we should not attempt to spray droughty stands of mesquite. We feel that reliable criteria for recognizing the degree of susceptibility of any particular mesquite stand are needed. We are now attempting to work out such criteria with the hope that we can eventually state with certainty that spraying on a particular area will result in effective kills.

RECENT ACCOMPLISHMENTS IN RANGE RESEEDING

By H. W. Springfield

Interest in and knowledge of range reseeding has increased steadily since the research program of the Southwestern Forest and Range Experiment Station was expanded to include reseeding studies in 1945. Successful reseeding of large areas based upon research experience has changed reseeding from a possibility to an actuality and stimulated widespread interest.

We can now provide recommendations for reseeding deteriorated rangelands of better soils in the ponderosa pine, big sagebrush, and pinyon-juniper woodland types. Our policy has been to first reseed sites with higher rainfall and better soils where chances for success are greater. During the last three years, large-scale plantings in the moister parts of the sagebrush and woodland types and pine openings totaled over 15,000 acres.

Site preparation, which is essential for successful reseeding, removes competing vegetation and prepares the surface soil. Generally, disk-type plows, such as the brushland plow, developed by the Forest Service, and the Towner heavy-duty offset disk, are most effective for site preparation. This type of equipment effectively and economically eradicates big sagebrush, snakeweed, pingue, and other competing vegetation. Drilling has proven best for distributing seed uniformly and insuring proper depth of coverage. However, on well-prepared seedbeds broadcasting seed and covering it with a drag or harrow has given good results.

One recent development is reseeding of burns in the pine type for soil stabilization. Research plantings show that annual species, such as the mustards, and fast-growing perennial grasses, like intermediate and slender wheatgrass, are effective for providing a protective soil cover. This year 9,000 acres of burned pineland in the Sacramento Mountains on the Lincoln National Forest were seeded.

The current drought has provided an "acid test" for reseeding. Species surviving this almost unprecedented series of dry years possess remarkable drought resistance and are worthy of consideration for large-scale plantings. In the moister ponderosa pine rangeland most of the wheatgrasses, several fescues, and bluegrasses have survived while only the wheatgrasses have done well at the moister big sagebrush and woodland sites. The wheatgrasses especially and several other grasses succumbed to drought in the drier sagebrush and woodland areas. Two well-established, four-year-old stands of crested wheatgrass were practically drought-killed this year as well as a two-year-old stand of intermediate wheatgrass. The wheatgrasses are near the lower extent of their range of adaptability in the Southwest, and the drought has taught us not to try to push the wheatgrasses too far south or into too dry a situation.

In spite of the drought, over 60 percent of our reseeding has been successful during the past two years. Until this year about 90 percent of our plantings have succeeded. Recurring droughts characterize the Southwest, and a certain percentage of failures in our plantings must be accepted; and from an economic standpoint must be added to the cost of reseeding.

Several of our present studies are aimed at learning how to graze established reseeding stands so they will be maintained. We are also moving into the more difficult and drier parts of the sagebrush and woodland types and the semidesert grasslands. Answers will come more slowly because of the more erratic rainfall and higher temperatures which pose real obstacles to successful reseeding. While answers are being sought for these drier sites, sufficient knowledge is available for large-scale reseeding of deteriorated openings in the ponderosa pine forest and in the moister, big sagebrush and pinyon-juniper ranges in need of improvement.

TYPE AND SIZE STUDIES IN BEEF CATTLE

By Ralph M. Durham

Much has been said and written about type and size in beef cattle. In 1945 a study was begun to determine the relationship of type and size with some of the economically important characteristics such as weaning weight and grade.

At the beginning of the experiment two groups were selected from the experimental herd. One group called "large" was selected on weight. One group called "compact" was selected on compactness. A third group called "medium" was formed of those cows which were not in either of the other two groups. Each group of cows has been mated to bulls similar in type and size to that particular group. Replacements have been selected from their progeny.

Data have been gathered on five calf crops from the original cows and their descendants. There have been 125 compact, 169 large, and 262 medium calves produced.

The table shows the mean weights of the wet cows at weaning time and the mean weights and grades of the calves at weaning time:

Wet Cow Weights, Calf Weights, Calf Grades, and the Calf Weights
Expressed as a Percentage of the Cow Weight by Groups

| Group | Cow Wt. | Calf Wt. | Calf Grade ^{1/} | Calf Wt.
as % of
Cow Wt. |
|-----------|---------|----------|--------------------------|--------------------------------|
| Compact | 934 | 417 | 5.92 | 45.7 |
| Medium | 974 | 448 | 5.68 | 46.2 |
| Large | 1066 | 469 | 5.48 | 43.5 |
| L minus C | 132 | 52 | -.44 | -2.2 |
| L minus M | 92 | 21 | -.20 | -2.7 |
| M minus C | 40 | 31 | -.24 | .5 |

^{1/} Grade is based on A⁺ equals 8, A equals 7, etc.

Since it is of interest to know the relative productivity of the cows, the calf weights at weaning time were calculated as the percentage of their mothers' weights. The lower rows of the table give the differences between the groups for the particular characteristics.

The mean weights indicate a clear and significant advantage in weaning weight for the calves from the large cows over the calves from the compact cows. The mean grades indicate a clear and significant advantage for the calves from the compact cows over the calves from the large cows. The calves from the medium group lie in between the other two groups for both characteristics. It thus appears that selection for compactness or selection for size, whichever the case may be, is effective.

Although the large cows undoubtedly produce larger calves at weaning, they do not produce more in proportion to their body weight than do the compact and medium cows. Actually the compact and medium cows have produced about 2 to 3 percent more pounds of calf, in terms of their body weight, than have the large cows. This might be explained in part by the tendency of the progeny of individuals selected at two extremes to be less extreme than their parents. In other words, the smaller cows tend to have slightly larger calves and the larger cows slightly smaller calves than expected on the basis of the ratio between the body weights of the mothers.